Working Paper F.7

GARM3 System Capacity Analyses

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This Working paper will address TOR 3 of section: F. Ecosystem Data for use in stock assessments. It will provide analyses to determine if the Northeast Shelf Ecosystem can support the larger biomasses required for the GARM species as well as the other important fish stocks in the region.

TOR 3

3. Identify candidate measures of system-level productivity.

There has been some concern expressed (by numerous stakeholders) whether all 19 groundfish (and more broadly, the entire fish community and even all targeted species) can have biomass simultaneously at optimal levels (e.g., B_{MSY}). We propose four approaches to address this question. Here we provide a general description of each and the underlying data to be used.

Prior to executing any of these approaches, we will compile a table of recent B_{MSY} estimates for all GARM species, major finfish species, and all targeted species for the entire northeast U.S. shelf ecosystem. We will then convert these to total metric tons for the shelf, t km^{-2}, and comparable units to facilitate comparisons and use in the approaches below.

The four proposed approaches are:

1. Converted energy budget values will be calculated to provide context, compare to other ecosystems, and be rebalanced to see if simultaneous optimal biomass is even feasible. This work will build upon the EMAX exercise, will use two network models, and will be primarily a bounding exercise. The comparative and rebalanced scenarios approach will serve the primary aim of evaluating the feasibility of optimizing yields for the 19 groundfish stocks in the context of the entire ecosystem (including all finfish and all commercially targeted species).
   Lead: J. Link, supported by Fogarty, Overholtz, and the EMAX team.
   Key reference: Link et al. 2006. NEFSC CRD 06-15, 166 pp.

2. A simple transfer efficiency calculation will apply the overall productive capacity of the system as a limit/constraint for fish stock production at their various trophic levels. Although a relatively simple calculation (viewed as a straightforward, statistical/algebraic model), there are several nuances and sensitivities to be explored regarding assumptions about trophic level of targeted species, but this would again account for the total system context. Again, this will explore the feasibility of simultaneously optimizing harvest for all GARM, finfish, and targeted species.
   Lead: M. Fogarty, supported by Link, Overholtz, Hare, Friedland.
   Reference: Christensen & Pauly 1995. Naga 18(3):34-40.

3. An aggregate production model will be fit using ASPIC or a similar production model for all 19 groundfish and commercially targeted species as one "mega" stock and associated fishery. This model will also evaluate the entire finfish community and then all targeted species. This model will provide the overall carrying capacity for this group of stocks as a whole, focusing on the GARM stocks of emphasis. Common estimates of BRPs (e.g., carrying capacity and resultant aggregate B_{MSY}'s) will be calculated in aggregate groupings and in total. The aim will be to calculate aggregate BRPs to compare to summations of single species BRPs.
   Lead: W. Overholtz, supported by Link, Fogarty, Jacobson, and FWDP post-doc.
   Reference: Prager 1994. Fish. Bull. 92:374–389.

4. A multi-species production simulation model will be used to bound the sensitivities of the issue. This model does not fit data, but uses data-derived parameters to test different harvesting or ecological scenarios. Parameters from the data and model outputs above will be used to initialize the model. The model will primarily explore the feasibility of various ecological and harvest scenarios for all 19 GARM, finfish and targeted species and resultant system level yields, biomasses, and carrying capacities.
   Lead: J. Link, supported by Overholtz, Fogarty, Legault, half time FWDP contractor staff, and FWDP post-doc.
   Reference: Link 2003. ICES CM 2003/Y08 28 pp.

Main databases to be used will include:
Shore up these references/this section?!?

Standard fisheries dependent and independent data (survey and catch estimates)- described in further detail elsewhere in GARM data documentation (see SVDBS, CFDBS, OBDBS; several refs).

Food habits database (see FHDBS, Link & Almeida 2000)

Satellite derived (and sea-truthed) primary production (see O'Reilly & Zetlin 1998)

Zooplankton database (see ECOMON; Hare, Kane)

Benthic database (see BENDBS, Wigley & Theroux 1999)

Physical oceanographic database (see OCDBS, other related DBSs; Friedland, Hare; Taylor et al. 2005)